Express Mail Label Jo. EL449097438US   Date of Deposit: 10/30/03

1

MAIL IMAGE PROFILING AND HANDWRITING MATCHING

CROSS REFERENCE TO RELATED APPLICATIONS

[0001]    This application claims priority of U. S. Provisional Application 60/422,311 filed on October 30, 2002, which is herein incorporated by reference.

BACKGROUND OF THE INVENTION

[0002]    This invention relates generally to the detection of hazardous material and, more particularly, to the application of image processing to early detection of potentially hazardous material associated with mail collection or the collection of other objects.

[0003]    Recently there has been increased awareness of the potential for large-scale introduction of hazardous materials, for example, biological organisms, to create chaos or to harm an intended set of victims.  One potential delivery method that terrorists or other criminals utilize to deliver such hazardous materials is through the mail or other form of a delivery.  In so doing, not only is damage incurred by the intended victims, but also by any set of potential victims that may be in a position of handling such objects as the mail during the delivery or distribution process.

[0004]    There is currently technology available to law enforcement organizations for detecting the presence of chemical and biological threats.  Such test materials generally are sensitive to specific hazardous materials and are utilized by directly putting them in contact with such hazardous materials.

15

Table 1: Detectable Image Characteristics List

| Detectable Image Characteristics |
| --- |
| Destination address Resolution |
| Barcodes (FIM, PLANET, POSTNET in one embodiment) |
| Return Address Determination |
| Envelope Size |
| Destination/Return Address Style |
| Clear Area Infringement |
| Destination Address Infringement |
| Stain |
| Postage Characteristics |
| Type |
| Excessive Postage |
| Restrictive Markings |
| Return address Resolution (including misspellings) |
| Envelope Characteristics |
| Handwriting Similarity |

Mail piece characteristics requiring more sophisticated
algorithms for detection are grouped into later phases for
deployment.

[0037]   Exemplary, but not limited to, image-detectable
mail piece characteristics, addressing degrees of effectiveness
and accuracy, development time, image type, and relative
processing power required, as described herein below.

[0038]   Handwriting Matching, the capability to analyze
handwriting or hand-printing on mail images to determine
similarity to that of other (evidence) documents, is potentially

21

* Excessive Postage - The following embodiments, but not limited to, can distinguish instances of probable excessive postage. An assessment of the extent and shape of the postage area may be obtained from image processing of the binary (bi-tonal) images. Combined with the neural net technology described above for determining Postage Type, this method could assess the probability of presence of multiple stamps. The result is a probabilistic indication of excessive postage.

A more precise determination of the postage amount on an envelope requires processing grayscale images in order to recognize in detail specific stamp images and their amounts.

8) Restrictive Markings - The possible presence of restrictive text such as the words "Personal" or "Confidential" may be detected by means of image character recognition. In some embodiments, the image processing could be performed at the remote image reading and processing system (RCR) 2. For handwritten marks, the detection would require handwriting analysis and may be more appropriately performed offline. For machine printed mail, optical character recognition results, usually obtained at the remote image reading and processing system (RCR) 2, enable searching machine printed text for keywords.

9) Clear Zone Infringements - Several embodiments, but not limited to, of methods for detecting Clear Zone Infringements are disclosed below. Referring to Figures 2 and 5, the bottom band of envelope images seen by the remote image reading and processing system (RCR) 2 is normally clear, as this is the area in which a (POSTNET) barcode 90 is printed after the remote image reading and processing (and video coding if applicable) is

24

| Characteristic | Categories | Image Type | Detection Rate | Accuracy |
|---|---|---|---|---|
| 4) Return-Address Style | • Not present | Bi-Tonal | Moderate | Moderate |
| | • Handwritten (any form) | Bi-Tonal | Moderate | Moderate |
| | • Hand printed<br>• Hand cursive | Bi-Tonal | Moderate | Moderate |
| | • Machine printed (any form) | Bi-Tonal | Moderate | Moderate |
| | • Machine solid<br>• Machine broken<br>• Machine dot-matrix | Bi-Tonal | Moderate | Moderate |
| 5) Return Address Resolution | • Invalid address (ZIP+4 Directory) | Bi-Tonal | Moderate | Moderate |
| | • Invalid address (DPF Directory) | Bi-Tonal | High | High |
| | • Non-local return address | Bi-Tonal | Low (HW)<br>Moderate (MP) | Moderate (HW)<br>High (MP) |
| | | Bi-Tonal | High | High |

25

| Characteristic | Categories | Image Type | Detection Rate | Accuracy |
|---|---|---|---|---|
| | • Postal Code (Zip) Match (against a list of ZIPS) | Bi-Tonal | Low (HW)- 5 digits Moderate (MP)to High -11 digits | High |
| 6) Envelope Size & Skew | • Envelope Length • Envelope Height | Bi-Tonal | High | High |
| | • Envelope Skew | Bi-Tonal | Moderate | Moderate |
| 7) Postage Characteristics | • Postage Type (Stamp, Metered, Pre-printed, Embossed) | Gray | Moderate | Moderate |
| | • Excessive Postage | Bi-Tonal | Moderate | Moderate |
| | | Gray | High | High |
| 8) Restrictive Markings | Configurable list of keywords ("Personal", "Confidential", etc.) | Bi-Tonal | Low (HW) Moderate (MP) | Moderate (HW) High (MP) |
| 9) Clear Area Infringement | • Destination Address Infringement | Gray | Moderate | Low |

26

| Characteristic | Categories | Image Type | Detection Rate | Accuracy |
|---|---|---|---|---|
| | • Stain | Bi-Tonal | Low | Low |
| | | Gray | Moderate | Moderate |
| 10) Handwriting Matching | Similarity score (degree of similarity to image of evidence mail) | | | |

Table Legend:

Image Type: Type of image required to support detection of the image characteristic:

| Bi-tonal: | Current bi-tonal images of the front of the envelope are usable |
| Gray: | Grayscale images required |
| Color: | Color images required |

Detection Rate: An estimate of the frequency of false negatives - instances where a mail piece exhibits the characteristic but the system fails to detect and indicate it:

| Low | UP to 25% false negatives |
| Moderate | Up to 15% false negatives |
| High | Up to 5% false negatives |
| Very High | Approximately 1% - 2% false negatives |